

CLIMATE CHANGE FACTS

CORNELL COOPERATIVE EXTENSION

THE EARTH'S CHANGING CLIMATE

Have you noticed that trees are budding earlier in the spring, that summer heat waves are more common than they used to be, or that when it rains, it pours? What you are witnessing is part of a global change in the Earth's climate. Scientists once thought climate change would take many generations to be felt, but instead we are already experiencing its dramatic effects.

Historically, the Earth's climate has fluctuated, but natural factors alone cannot explain today's rapid pace of change. There is overwhelming evidence that an increase in gases like carbon dioxide (CO₂) in the atmosphere is causing this transformation.



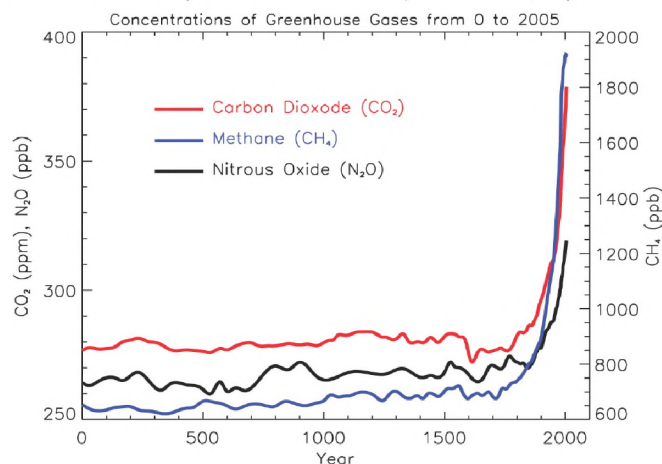
THE GREENHOUSE EFFECT

For decades scientists have known that without the so-called "greenhouse gases" the atmosphere of our planet would be a cold -4°F, rather than the average temperature of about 60°F that supports the abundant and diverse life with which we are familiar. Important greenhouse gases (GHGs) include carbon dioxide, water vapor, methane, and nitrous oxides. The sun's energy passes through these gases, like light passing through a window, but then they trap the heat that develops at the Earth's surface like a blanket laid end-to-end across the planet.

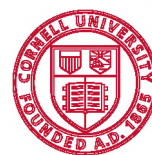
RISING GREENHOUSE GASES AND CLIMATE CHANGE

Since the Industrial Revolution of the 1800s, the amount of CO₂ in the atmosphere has risen by almost 40 percent. This is attributed primarily to the burning of fossil fuels (coal, oil, gasoline). Methane and nitrous oxides are also increasing rapidly, due in part to the expansion of agriculture and use of nitrogen fertilizers. These are present in only trace amounts, but are more potent greenhouse gases than CO₂.

The increases in these three greenhouse gases coincide with a worldwide increase in temperature. Since the 1800s, the Earth has warmed by more than 1.5°F. In New York, the average summer temperature is already 2°F warmer than in 1970, and winter temperature is 4°F warmer. The Earth is now warmer than it has been during the past several thousand years, and the climate models project a continuation of this trend. The water cycle is also being affected, with fewer snow cover days and heavier rainfall events in New York.



*This figure shows atmospheric concentrations of important long-lived greenhouse gases over the last 2,000 years.
– IPCC Fourth Assessment Report (2007).*



A WORLD OF CLIMATE OBSERVATIONS

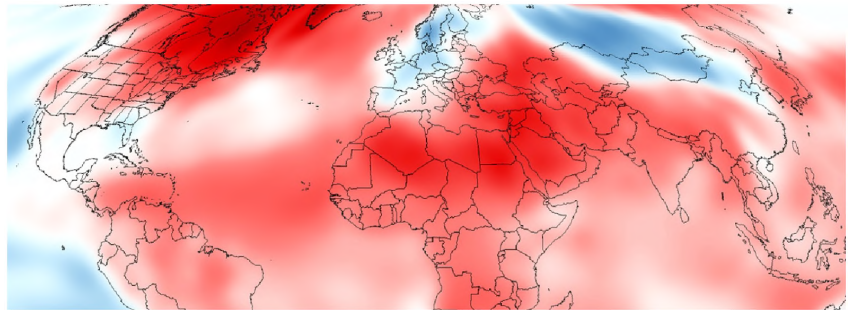
We know the climate is changing because we have a wealth of data from a worldwide network of weather stations, many of them with records going back more than 100 years. Weather balloons and satellites measure the temperature of the upper atmosphere. Paleoclimate data from ice cores and tree rings can be used to infer temperature and precipitation patterns over thousands of years. These data help us to better understand current changes in climate and place it into historical perspective. Sophisticated Global Climate Models (GCMs) replicate these past and current climate conditions and are able to make accurate predictions about the changes in climate we will see in the future.



Weather stations around the world have been collecting weather data for more than 100 years. These long-term weather records tell us our climate is changing. US Climate Reference Network stations like this one near Cornell University (Ithaca, NY) provide high quality temperature and rainfall observations.

BUT THIS YEAR WAS NOT AS WARM AS LAST YEAR

In the midst of the overall warming trend we are experiencing, individual years may be colder or warmer than other years due to diverse factors that affect weather, like jet stream patterns, volcanic eruptions, or natural conditions such as El Niño. Climate change refers to shifts that occur over long periods—decades or longer—while weather refers to the day-to-day and year-to-year variability that is familiar to us all. Just because one winter season is particularly cold does not mean that New York's climate is not changing, the long-term climate data show that it is.



According to the NOAA National Climatic Data Center, 2010 was tied for the hottest year on record. Red colors indicate areas that were warmer than the historical average; blue colors indicate areas cooler than the historical average (2011).

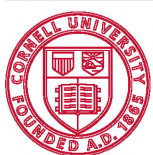
CLIMATE CHANGE RESEARCH, TEACHING AND EXTENSION OUTREACH AT CORNELL

Cornell University is one of the nation's leading institutions contributing to climate change research in many fields, such as atmospheric science and climate modeling, climate impacts on agriculture, horticulture and natural resources, and the economic, policy and societal implications of climate change. Cornell University faculty, staff and Cooperative Extension educators are working together through the Cornell Climate Change Program Work Team to develop materials such as this fact sheet. For more specific information on climate change impacts in New York, go to www.climatechange.cornell.edu.



Cornell University researchers and Cornell Cooperative Extension educators are working together to educate New Yorkers about energy and climate change issues.

Prepared by: Art DeGaetano, Allison Chatrchyan, David Wolfe, Jeff Beem-Miller, Lauren Chambliss, and Holly Menninger. Designed by DragonFishStudio.com



CONTACT: Dr. Art DeGaetano, Dept. of Earth and Atmospheric Sciences
nrcc@cornell.edu, www.climatechange.cornell.edu

CLIMATE CHANGE FACTS • THE EARTH'S CHANGING CLIMATE • September 2011 • Climate Change PWT • PAGE 2
 Cornell University provides equal program and employment opportunities